MINERALOGY AND PETROGRAPHY.[1]

The Basalt of Stempel.—Bauer's[2] description of the basalt of Stempel, near Marburg, and its concretions and inclusions is one of the most excellent pieces of petrographical work that has appeared in a long time. A favorable opportunity has enabled the author to secure a splendid suite of specimens of this rock so noted for its beautiful zeolites. It consists of the usual constituents of basalt, viz.: plagioclase, augite and olivine in a groundmass of augite and feldspar microlites in a base of glass. The plagioclase is andesine without peculiar characteristics. The augite is also without special features except that it is frequently zonally developed, with a dark-green kernel and brown-colored coats, in which the extinction decreases from 48° to 36°. The olivine is so well bounded by crystal planes that the relations of the shapes of the cross-sections to the crystallographic axes have been well worked out. Twins parallel to $P\breve{\infty}$ are not uncommon. The liquid inclusions, upon careful study, are found to differ from those of the olivine of the concretions (Knollen), and the glass inclusions are learned to have a different composition from the glass forming the groundmass of the rock. One of the most interesting features of the rock is the occurrence of amygdaloidal cavities, coated within by a layer of glass, whose limits are sharply defined. Sometimes a partition of this glass divides a cavity into two, and occasionally several concentric partitions give rise to a series of chambers that are strikingly like the chambers in Idding's lithophysae. The olivine bombs included in the rock consist largely of bronzite and chrome-diopside grains cemented by olivine substance. The bronzite is present in two varieties, one an almost opaque greenish-brown kind, and the other a transparent olive-green variety. Picotite is also present quite abundantly in grains and aggregates of grains in most of the bombs. The effect of the action of the rock magma upon its inclusions is seen in the granulation of the pyroxenes, and the effect of the material of the bombs upon the magma is shown in the presence of microlites of hypersthene in the veins of the rock that ramify the bombs. Since the minerals of the bombs contain characteristic inclusions not common to lherzolitic rocks, and since, moreover, the olivine and bronzite are sometimes found in forms never seen in lherzolite, the author

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Neues Jahrb. f. Min., etc., 1891, ii, p. 156.

concludes that these bodies are not inclusions torn from a deep-seated basic rock as is sometimes thought, but that they are concretions of the basic minerals of the basalt, formed during the intratellurial period of its magma's history. Another interesting feature of the Stempel occurrence is the abundance and variety of true inclusions found therein. These are limestone, quartz, feldspar and amphibolite fragments and others torn from a cordierite rock. The limestone has produced but little effect upon the surrounding rock other than rendering its texture coarser by increasing the size of its feldspathic constituents. The limestone itself has suffered little change. The quartz fragments are all surrounded by rims of green augite crystals, and in their interior they are filled with swarms of cavities either empty or filled with liquid. Sandstone inclusions now consist of grains of quartz, cemented by a glass that has originated in the fusion of the cement of the original rock. This glass sometimes contains trichites and magnetite grains, when it is colorless; sometimes it is devoid of them and is colored brown. The glass cement also frequently contains drops of glass that differ from the enclosing material in that it dissolves readily in hydrochloric acid, while the latter is unaffected by this reagent. The included substance is regarded as the pure glass produced by the solution of the cement of the sandstone, while the insoluble variety is that to which silica has been added by the corrosion of the quartz grains. The finer grained sandstones have yielded basalt-jasper. In their glassy constituent are numerous crystals of apatite that are similar in most of their properties with the nepheline and cordierite crystals observed by Zirkel in some of the basalt-jaspers described by him. The orthoclase inclusions are penetrated by tiny veins of glass. Both the feldspar and the glass contain small violet octahedra of some spinel and blue pleochroic needles of glaucophane, while tridymite plates occur in the latter substance. An aggregate of orthoclase and plagioclase contains flecks of green glass between the grains that is thought to be fused mica, while the feldspar is filled with sillimanite needles. The other inclusions present features that are worthy of notice, but they cannot be described in the present place. The article will well repay the reader for its perusal.

The Crystalline Rocks of Tammela, Finland.—The archean rocks in the vicinity of Tammela, in the South-western part of Finland, are crystalline schists, granites, gabbros, porphyrite and vitrophyres. A gray granite, Sederholm[1] thinks, is closely related to the

[1]Min. u. Petrog. Mitth., xii, p. 97.

gabbros and diorites of the region, which appear as though basic separations from the same magma as that yielding the granite. The most abundant rock is a muscovite granite. Next in importance is a uralite-porphyrite, whose uralitic phenocrysts are complete pseudomorphs of augite. All the constituents of the rock show much alteration. The plagioclase is changed to epidote and zoisite, and between the secondary products of this mineral are newly formed plagioclase and hornblende, and in addition there are frequently accumulations of biotite, whose form leads to the supposition that they are pseudomorphs after olivine. In its original condition this rock was probably a basalt. A plagioclase-porphyrite, an amygdaloid and glassy rocks with the composition of an acid basalt also occur in the region. Tufas accompanied the outflow of basalt, but in this as in the other rocks described the character of the original substance has been greatly obscured by alteration. In discussing the cause of the chemical changes that have been effected, the author ascribes the most powerful action to water in connection with pressure. Many of the rocks show evidences of dynamo-metamorphism. A schistosity has been superinduced in nearly all of the types, but the crushing and breaking of grains that are such striking phenomena in most instances of this kind, are here absent. The pressure exerted its influence principally in increasing the solvent power of the water. Very little change in the chemical composition of the rocks has resulted from the alteration, in spite of the fact that their mineralogical composition has been totally changed.

Petrographical Notes.—The breccias and porphyries of Pilot Knob, Mo., have repeatedly been stated to be metamorphised fragmentals. Haworth[1] has examined their relations to other rocks and has carefully studied their thin sections with the result that they are pronounced by him true eruptives, the latter, quartz-porphyries, exhibiting flowage structure, and other evidences of having once been liquid, and the former, porphyry breccias, with fragments of porphyry cemented by a groundmass that was once a fluid volcanic lava.—— Cordierite-bearing chiastolite schists are briefly mentioned by Klemm[2] as forming part of the contact belt of the Lausitz granite at Dubring, and dykes of hornblende-porphyrite as cutting the granite at this place and at Schmerlitz, in Saxony.——In a brief communication Kemp[3] speaks of the existence of several dykes of a very much altered

[1]Bull. No. 5, Geol. Surv. of Mo., p. 5.

[2]Zeits. d. d. Geol. Ges., xliii, 1891, p. 526.

[3]Amer. Jour. Sci., Nov., 1891, p. 410.

peridotite in the Portage sandstones near Ithaca, N. Y.——In a hornblende-andesite inclusion in the Capucin trachyte Lacroix[1] finds one cavity containing magnetite, biotite, fayalite and hypersthene—a different association of minerals from that in any other cavity. The most interesting of these minerals is the fayalite, which occurs in tiny crystals with a golden yellow color, due to a ferruginous pigment.

Mineralogical News.—A series of new analyses of *amarantite* from the Mina de la Campania, near Sierra Corda, Chile, give: $SO_3 = 35.46$; $Fe_2O_3 = 37.46$; $K_2O = .11$; $Na_2O = .59$; $H_2O = 28.29$, corresponding to $Fe_2\ S_2O_9 + 7H_2O$. The mineral has a specific gravity of 2.286, and at 110° it loses three molecules of water. Its axial ratio as determined by Penfield[2] is $a : b : c = .7692 : 1 : .5738$ with $\alpha = 95° \ 38' \ 16''$; $\beta = 90° \ 23' \ 42''$, $\gamma = 97° \ 13' \ 4''$, and 2Ena = 63° 3′. In sections parallel to the trachy-pinacoid the extinction is 16°–17° in acute β. *Sideronatrite* from the same place occurs in fine orange or straw-yellow fibres, with orthorhombic symmetry (not monoclinic as Raimondi asserts). Its density is 2.355. A mean of several analyses yielded:

$$\begin{matrix} SO_3 & Fe_2O_3 & Na_2O & H_2O \\ 44.22 & 21.77 & 16.39 & 17.07 \end{matrix} = 2Na_2\ SO_4\ Fe_2\ S_2O_9 + 7H_2O.$$

The mineral suffers a loss of four molecules of water at 110°. Associated with sideronatrite are little white masses composed of a substance with hexagonal optical properties. It is positive with $\omega = 1.558$, $\epsilon = 1.613$ for yellow light. Its density = 2.547–2.578, and its composition is: $H_2O = 11.89$; $SO_3 = 51.30$; $Fe_2O_3 = 17.30$: $Na_2O = 19.63$; $K_2O =$ ca. .16, corresponding to $3Na_2\ SO_4, Fe_2(SO_4)_3 + 6H_2O$. With these analyses are also given those of a *picropharmacolite* from Joplin, Mo., of *pitticite* from the Clarissa Mine, Utah, of *gibbsite* from Chester Co., Pa., and of *atacamite* from Chile. The analysis of the first mentioned mineral leads to the formula $(H_2\ Ca\ Mg)_3\ As_2\ O_8 + 6H_2O$. The pitticite gave: $H_2O = 17.64$; $As_2O_5 = 39.65$; $Fe_2O_3 = 33.89 = 4Fe_2(As\ O_4)_2.\ Fe_2(OH)_6 + 20H_2O$. The mineral is not a mixture of the sulphate and arsenate of iron as is the German variety. No definite conclusion was reached as to the composition of the gibbsite other than that it is a hydrous aluminum phosphate.——Though *columbite* has been known to exist in the Black

[1]Bull. Soc. Franc., d. Min., xiv, p. 10.

[2]Zeits. f. Kryst., xviii, p. 585.

Hills in Dakota for some six years past, the first accurate account of its occurrence and of its composition has but just been communicated by Mr. Headden.[1] The mineral together with *tantalite* is often present in the stream-tin of the hills. It is also found imbedded in beryl at the Etta Mine and associated with other minerals at the various other mines in the district. Fourteen analyses of crystals obtained from the different localities are given. Some of these correspond with the formula $3R\ Cb_2O_6 + 2R\ Ta_2O_6$, with $R = Fe_{\frac{1}{2}}\ Mn_{\frac{1}{2}}$. As the density of the mineral becomes greater the proportion of tantalum to columbium increases, passing from 1 : 6 to 1 : $1\frac{1}{4}$; thus indicating that columbite and tantalite are isomorphous substances. Analyses follow: I. Turkey Creek, Col.; II. Yolo Mine, S. Dak.; III. Tantalite, associated with stream tin at the Grizzly Bear Gulch, S. Dak.; IV. Manganiferous columbite, from Advance Claim, $1\frac{1}{2}$ miles S. of Etta Mine.

	Cb_2O_5	Ta_2O_5	SnO_2	WO_3	FeO	MnO	CaO	Sp. Gr.
I.	73.45	2.74	.21	1.14	11.32	9.70	.61	5.383
II.	24.40	57.60	.41		14.46	2.55	.73	6.592
III.	3.57	82.23	.32		12.67	1.33		8.200
IV.	47.22	34.27	.32		1.89	16.25		6.170

Mr. Headden's results are interesting as indicating the widespread occurrence of these two rare minerals in the Black Hills region, and his paper is valuable for the great number of analyses contained in it. ——Laspeyres[2] has reexamined the *saynite* (of V. Kobell) from Grube Grüneau, in Kirchen on the Sieg, in Germany, where the mineral occurs in crystals. He finds it to be a mixture of polydymite with other sulphides, as he declared it to be some time since. *Ullmanite* crystals from Siegen, in the same neighborhood, are described as consisting of cubes with striations parallel to the pyritoid edge, or of cubes, dodecahedrons and octahedrons combined with more complicated forms, among which are many parallel hemihedral ones. Its crystallization thus corresponds with that of the Sardinian Ullmanite described by Klein.[3] A rare chance was also afforded Laspeyres for the study of the crystallization of *wolfsbergite*, from Wolfsberg, in the Harz. The new crystals obtained by him are tabular parallel to oP,

[1]Amer. Jour. Sci., Feb., 1891, p. 89.

[2]Zeits. f. Kryst, xix, 1891, p. 417.

[3]Neus. Jahrb. f. Min. etc., 1883, i, p. 180 and 1887, ii, p. 169.

and have the macro-zone more highly developed than the brachy-zone. They show clearly that Groth is correct in regarding the mineral as isomorphous with amplectite, scleroclase and zincenite. The axial ratio, calculated from pyramidal faces that gave good reflections, is $a : b : c = .5283 : 1 : .6234$.——The little-known members of the *mesotype* group on the Puy-de-Dôm have recently been described by Gonnard[1] in some detail as regards localities. An analysis of the natrolite from the Puy-de-Maman yielded: $SiO_2 = 48.03$; $Al_2O_3 = 26.68$; $Na_2O = 15.61$; $H_2O = 9.62$; and that of the Tour de Gevillat gave: $SiO_2 = 47.88$; $Al_2O_3 = 26.12$; $Na_2O = 15.63$; $CaO = .45$; $H_2O = 9.80$.——The same author[2] has made a crystallographic study of the *barites* of the Puy-de-Dôm. All crystals of this substance are beautifully modified but none show new forms. A peculiarly habited *aragonite*[3] from the Neussargnes Tunnel, Cantal, contains the new forms $\frac{13}{3}P\breve{\infty}$ and $\frac{3}{2}P$.——The investigation of the nature of the nitrogen found in *uraninite*, promised some time ago, has been continued by Hillebrand[4] without, however, very great success. The most careful analyses of specimens from Glastonbury, Ct., and from Arendal, Norway, yield respectively:

UO_3	UO_2	ThO_2 etc.	PbO	CaO	H_2O	N	Fe_2O_3	SiO_2	Insol.	Sp. Gr.
23.03	59,93	11.10	3.08	.11	.43	2.41	.29	.16	.89	9.622
26.80	44.18	13.87	10.95	.61	undet.	1.24	.24	.50	1.19	

The principal result of the analyses is to the effect that all uraninite contains more or less nitrogen, sometimes amounting to as much as $2\frac{1}{2}\%$. The condition in which the element exists is unknown, but it is probably different from any hitherto observed in the mineral kingdom. Another result indicated is that the formulas that have been accepted as expressing the composition of the mineral do not do so. Specimens from many of the classical localities have been analyzed, and in nearly every case errors have been detected in the original analyses. The author concludes that while uraninite in general contains the same constituents, it varies widely in composition, and its physical characteristics are often as distinct as are the chemical differences.——The *keramohalite* from Pico de Teyde, in the Canary Isles, is in little imperfectly developed crystals imbedded in a yellowish white hygroscopic

[1]Bull. Soc. Franç. d. Min., 1891, xiv, p. 165.

[2]Ib., xiv, p. 174.

[3]Ib., xiv, p. 183.

[4]Bull. U. S. Geol. Survey, No. 78, p. 43.

granular mass, in the neighborhood of solfataras. The soluble substance extracted from this mass by Hof[1] gave:

SO_3	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	H_2O
38.62	13.96	.94	.66	.22	.04	2.37	42.01

The form of the crystals as determined by Becke[2] is tabular parallel to $\infty P\grave{\infty}$. They have a weak negative double refraction. The axis of mean elasticity is inclined 48° to $\infty P\bar{\infty}$, and that of the least elasticity 13° to $+P\bar{\infty}$. The crystallization is monoclinic with $a : b : c = 1 : ? : .825$ $\beta = 97° 34'$.——In the druses of a massive *garnet* used as a flux in the copper smelters at Kedobek, Caucasia, are found crystals of garnet that rival in beauty the famous Tyrol varieties. They are bounded by the forms 2O2, ∞O and occasionally $3O\frac{3}{2}$, and all the faces are brilliant. Their color is wine to honey-yellow and their composition[3] is represented by:

SiO_2	CaO	Al_2O_3	Fe_2O_3	Loss	
39.12	35.84	22.73	1.76	.15	$= Ca_3\ Al_2(SiO_4)_3$.

——According to Branner[4] inexhaustible beds of *beauxite* occur near Little Rock and Benton, Ark., that are supposed to be genetically related in some way with eruptive granites. The material is pisolitic in structure. The composition of one variety as shown by a partial analysis is:

Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Loss
55.64	10.38	1.95	3.50	27.62

——The handsome *calcite*[5] twins from Guanajuato, Mexico, that have been known for some time, are usually the scalenohedron R^3, twinned parallel to $-\frac{1}{2}R$. Corresponding pairs of faces on each individual are so developed that their combination has a monoclinic habit, resembling strongly the swallow-tailed twins of gypsum. The forms recognized in the crystals are mentioned in the paper and six figures accompany it.

[1]Min. u. Petrog., Mitth. xii, p. 39.

[2]Ib., p. 45.

[3]Müller: Neues. Jahrb. f. Min., etc., 1891, i, p. 272.

[4]Amer. Geologist, vii, 1891, p. 181.

[5]Pirsson; Amer. Jour. Sci., Jan., 1891, p. 61.

——Frenzel[1] has made a new analysis of *gordaite* and has found it to be identical with ferronatrite, while Arzruni has examined its crystals and declares them to be rhombohedral with $a : c = 1 : 55278$.——C. Schneider[2] gives good analyses of six basaltic hornblendes, all of which contain over 4% of TiO_2.

[1]Zeits. f. Kryst., xviii, p. 595.

[2]Zeits. f. Kryst., xviii, p. 579.